

REMARKS

Reconsideration and allowance of the subject application are respectfully requested.

Claims 1-3, 5-7 and 10-25 are pending in the application.

The allowability of claim 12 is acknowledged with appreciation.

Claim 1 has been amended to incorporate the subject matter of original claims 10-12. No new matter has been added.

Claims 10-12 have been amended be in independent form. Claims 3, 10 and 11 have been amended to correct minor informalities. No new matter has been added and none of these claims has been amended to overcome prior art. Thus, the doctrine of equivalents applies to each claim limitation.

Basis for new claims 18-25 can be found in the specification including at original claims 8-9. No new matter has been added.

In response to the Examiner's objections to the drawings at paragraph 3, page 2 of the Office Action, Fig. 1 has been amended to replace "(SC)" with "(RO)", Fig. 2 has been amended to recite "C", and Fig. 8 has been amended to replace "OC" with "C", as set forth above and shown in the attached marked-up copy of Figs. 1, 2 and 8 entitled "Annotated Sheet Showing Changes." No new matter has been added. Accordingly, withdrawal of the objection to the drawings and entry of the attached Replacement Sheets of Figs. 1, 2 and 8 is respectfully requested.

The specification has been as suggested by the Examiner in paragraph 6(a)-6(f) on pages 3-4 of the Office Action. No new matter has been added. Accordingly, withdrawal of the objections to the specification are respectfully requested.

The claims have been as suggested by the Examiner in paragraph 6(g)-6(j) on pages 4-5 of the Office Action. No new matter has been added. Accordingly, withdrawal of the objections to the claims are respectfully requested.

The rejection of claim 8 under 35 U.S.C. § 112, first paragraph, is obviated by the amendment to the specification set forth above to include the subject matter of original claim 8. No new matter has been added.

Applicant has shown by Example 2 in the present specification that the activated carbon produced by the process of the invention has the capacity to

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absorb mercury vapor and that this capacity is superior to conventional carbon material. (see Table 1). To one skilled in the art, it is known that mercury vapor is the most difficult metal to remove from a gas stream because it has the highest vapor pressure, since it is most easily vaporized, of any of the metal contaminants in flue gases. Thus, if mercury is able to be removed by the activated carbon then the other metal contaminants will also be removed.

Claims 8 and 9 of record have been cancelled and, in effect, submitted as new claims 18-25, which recite removing gaseous metal species with the novel activated carbon according to the invention at temperatures distinct from those required in claim 1. Applicant has found that more efficacious removal of gaseous metal species, particularly, mercury, from the SO_x-containing or other gases is carried out at lower temperatures than that required for the actual production of the activated carbon and sulphur removal defined by claim 1. Thus, claim 1 is not predicated on metal species removal for the four "products" defined in claim 1 to be obtained.

Applicant submits that the claims fully comply with Section 112, first paragraph. Accordingly, withdrawal of the Section 112, first paragraph, rejection is respectfully requested.

The rejection of claims 10-12 under 35 U.S.C. § 112, second paragraph, at pages 6-7 of the Office Action is obviated by the amendments to claims 10-12 as set forth above. Accordingly, withdrawal of the Section 112, second paragraph, rejection is respectfully requested.

The rejection of claims 1, 3-5, 10 and 11 under 35 U.S.C. Section 102(b) as anticipated by, or in the alternative, under 35 U.S.C. Section 103(a) a obvious over U.S. SIR H1538 (Harryman) is respectfully traversed. The claimed invention is not anticipated by or obvious over Harryman for the following reasons.

Harryman discloses process conditions requiring that "no substantial amount of coal" is oxidized. See for example, column 2, lines 22-23; lines 36-39; lines 42-44; lines 48-53; lines 59-60; and lines 65-67; and column 3, lines 6-7; and lines 22-27. Furthermore, claims 1, 9 12 and 18 of Harryman specifically define a solution to the consumption of the coal problem of the prior art. Harryman clearly teaches

against oxidizing coal.

The Harryman process and intention are in sharp contrast with and teach in a direction opposed to the present invention process wherein substantial oxidation of the coke using SO_x as the oxidant is required, in order to produce activated carbon according to the invention. Fig. 8 of the present invention shows the “burn-off” or oxidation of the coke. As the coke is activated the burn-off increases from a few percent to 85%. The burn-off is essential in producing an activated carbon and in converting the SO_x to elemental sulfur.

Furthermore, Harryman’s process is based on the absorption and/or absorption of gaseous sulphur species. See column 4, lines 34-38 of Harryman. In contrast, the present process, herein termed “SOactive” is a chemical process in which the oxidation of the coke is a necessary condition for both the removal of SO_x and the production of activated carbon. In fact, to again reiterate the Harryman object, Harryman states clearly that “the suitable temperature for the desulphurization process in the contactor is one of which **no** significant quantity of the coal is **oxidized**.” See column 6, lines 3-6 of Harryman. This is why Harryman only specifies the upper temperature limit. It is well-known in the art that an increased temperature lowers the effectiveness of absorption/adsorption-based desulphurization process.

Furthermore, Harryman is silent on the possibility of the production of activated carbon. In fact the addition of activated carbon into the coal mixture is suggested. See Harryman at column 4, line 29-32. This is in sharp contrast to instant process in which activated carbon is produced from the coke.

In Harryman’s process, the “sulphur laden coal” (Fig. 2, 301) is combined with the feedstock coal (Fig. 2, 602) for the gasifier’s coal burners (Fig. 2, 64). See column 6, line 49-54 of Harryman. The sulphur-laden coal is not a product stream and no property is disclosed. Although, Harryman, understandably, does not discuss any properties of the “sulphur-laden coal”, the chemical state of the sulphur in the “sulphur-laden coal” would be expected to be very different from that of Applicant’s activated carbon product.

In summary, Applicant points out that present process accomplishes several

tasks, simultaneously, as defined in claim 1 including desulphurization of e.g. flue gases, and the production of a novel activated carbon. Harryman neither discloses nor teaches a process that achieves these goals.

A person of ordinary skill in the art from the teachings of instant specification would readily appreciate that the process conditions of the present invention are distinct from those of Harryman, wherein the present process consumes coke while Harryman does not; and that the present process produces activated coke while Harryman, optionally, considers adding it to his process as a partial substitute for coal (Column 4, lines 29-32 of Harryman). Furthermore, since an essential feature of Harryman is the non-substantial consumption of coal, or the like, substitution with either delayed coke or fluid coke resulting in non-consumption thereof, still results in present claims being not anticipated and non-obvious. Accordingly, withdrawal of the Section 102 and 103 rejections is respectfully requested.

The rejection of claim 2 under 35 U.S.C. Section 103(a) as being unpatentable over Harryman alone or, in the alternative, in view of U.S. Patent No. 4,650,496 (Funk) is respectfully traversed. Claim 2 is not obvious over the cited references for the following reasons.

For the many reasons set forth hereinabove, combining the teachings of Funk with Harryman does not make claim 2 obvious since neither reference teaches the production of activated carbon from coke. Furthermore, one of ordinary skill in the art would not be motivated to even combine Harryman with Funk. The use of fluid coke, having properties being low in volatile content (Funk, column 5, lines 11-19) and surface area is clearly not desirable in Harryman's process. Funk describes and teaches the use of fluid coke for a completely different purpose, namely, making a water-based carbonaceous slurry. At Column 4, lines 69 – Column 5, line 1, Funk states that "Coke is the solid, cellular, infusible material...", which is highly indicative to a person of ordinary skill in the art that it is not possible to be activated. It is clear to such a skilled person that Funk from his description of fluid and other cokes would not teach use of fluid coke in Harryman's process.

As an aside, Applicant points out that the distinction between fluid coke and delayed coke is not trivial. Fluid coke is well-known in the art to be exceptionally inert

and difficult to activate. Prior art processes that activate delayed coke usually are not effective in treating fluid coke. However, in instant process, the distinctions between these forms of coke are not relevant. Indeed, the instant process has been demonstrated to treat the more refractory form of coke i.e. fluid coke. An important distinctive feature in instant process is that SO_x is the agent used for activation and that, unexpectedly, it is able to activate fluid coke.

In view of the many differences between claim 2 and the cited references, and the lack of motivation to combine Harryman and Funk, withdrawal of the Section 103 rejection is respectfully requested.

The rejection of claim 6 under 35 U.S.C. Section 103(a) as being unpatentable over Harryman either alone or, in the alternative, in view of U.S. Patent No. 3,615,219 (Budininkas) is respectfully traversed. Claim 6 is not obvious over the cited references for the following reasons.

For the many reasons set forth hereinabove in respect to Harryman, combining the disclosure and teachings of Harryman with the disclosure and teachings of Budininkas does not make claim 6 obvious since neither reference teaches production of activated carbon from coke.

Furthermore, one of ordinary skill in the art would not be motivated to combine Harryman with Budininkas. Budininkas' process is a catalyst-based chemical process using a gaseous reductant, while Harryman's process is an adsorption/absorption-based physical process. It makes sense for Budininkas' process to be used for smelter gas, since smelter gases can contain over 90% of SO₂ and often have a very large flow rate. In contrast, Harryman's process would, arguably, (a) not be economically feasible for SO₂ removal from smelter gases and (b) the recycle of "sulphur-laden coal" into the gasifier would defeat the original purpose of removing sulphur. See Harryman at Fig. 2.

Furthermore, Budininkas claims, describes and teaches the use of a gaseous reducing material selected from carbon monoxide, aliphatic hydrocarbon, hydrogen sulphide and hydrogen. Applicant points out that the source of sulfur dioxide is not a critical element of instant process. Indeed, any source containing significant sulfur dioxide would be acceptable. The flue gas and smelter gas sources are well-known

examples that contain sulfur dioxide.

Moreover, since Budininkas' process needs a catalyst and a reducing gas, it is not related to the SOactive process which uses a solid reductant and more uniquely converts the solid reductant to the activated ECOcarbon.

In view of the many differences between claim 6 and the cited references, and the lack of motivation to combine Harryman and Budininkas, withdrawal of the Section 103 rejection is respectfully requested.

The rejection of claims 8 and 9 under 35 U.S.C. Section 103(a) as being unpatenable over Harryman in view of U.S. Patent No. 6,451,094 (Chang) is respectfully traversed. Claims 8 and 9 not obvious over the cited references for the following reasons.

For the many reasons set forth hereinabove in respect to Harryman, combining the disclosure and teachings of Harryman with the disclosure and teachings of Chang does not make claims 8 and 9 obvious since neither reference teaches the production of activated carbon from coke.

As discussed above, the distinction between the forms of coke is not relevant. Using petroleum coke for the removal of mercury species as taught by Chang, would not be obvious to produce a mercury-free gas, since applicant has found that efficacious removal of mercury species under the process conditions of base claim 1 is not possible because of the effective SOx removal temperature being most unfavorably much higher than the mercury species adsorption temperature. There is nothing in Harryman, Chang or a combination of both to teach that mercury species either would (a) be non-efficaciously adsorbed, or (b) not adsorbed at all in the process defined in claim 1. Accordingly, withdrawal of the Section 103 rejection is respectfully requested.

The rejection of claims 1, 3 and 7 under 35 U.S.C. Section 102(b) as anticipated by, or in the alternative, under 35 U.S.C. Section 103(a) a obvious over JP 51-79676 (JP '676) is respectfully traversed. The claimed invention is not anticipated by or obvious over JP '676 for the following reasons.

JP '676 teaches the use of carbon powder for removing SOx and NOx at very low concentrations from exhaust gas from cement kiln. JP '676 teaches the

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treatment of exhaust gas from cement kiln that contains less than 1000 ppm (0.1 % v/v) of SO₂ or NOx (Table 1, page 355). This concentration is far below what is taught for applicant's SOactive process which requires at least 1% v/v or 10,000 ppm SOx to be efficacious.

JP '676 further teaches process conditions that use carbonaceous powder in only small amounts. This is in contrast to instant process which requires "significant consumption" of petroleum coke to produce activated carbon.

JP '676 does not disclose or even suggest the present process that simultaneously converts relatively concentrated SOx to elemental sulphur, removes NOx, and produces a sulphur-containing activated carbon material.

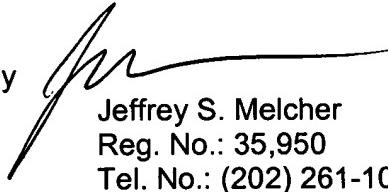
For these reasons, JP '676 cannot anticipate or make obvious claims 1, 3 and 7. Accordingly, withdrawal of the Section 102 and 103 rejections is respectfully requested.

In view of all of the rejections of record having been addressed, it is submitted that the present application is in condition for allowance and Notice to that effect is respectfully requested.

Respectfully submitted,

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IN THE DRAWINGS:

In Fig. 1, please replace "(SC)" with "(RO)" as shown by the marked up Fig. 1 and clean sheet Fig. 1 attached herewith.

In Fig. 2, please add "C" as shown by the marked up Fig. 2 and clean sheet Fig. 2 attached herewith.

In Fig. 8, please replace "OC" with " $^{\circ}$ C" as shown by the marked up Fig. 8 and clean sheet Fig. 8 attached herewith.

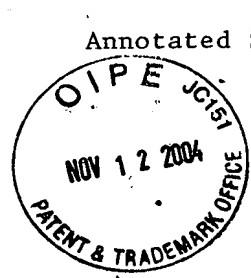


Figure 1

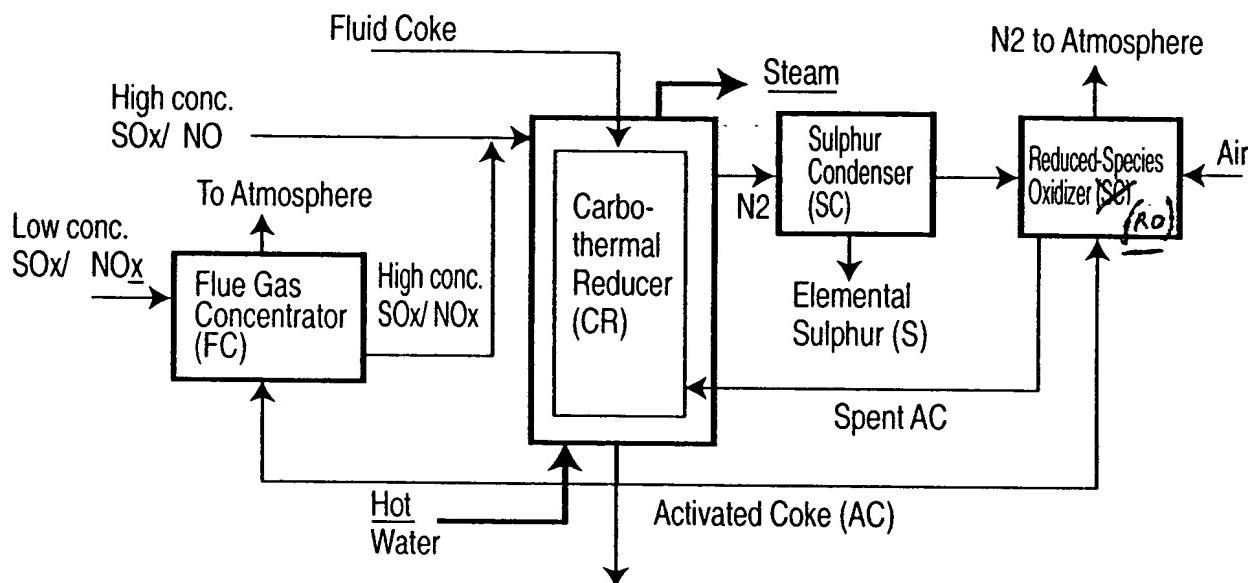


Figure 2

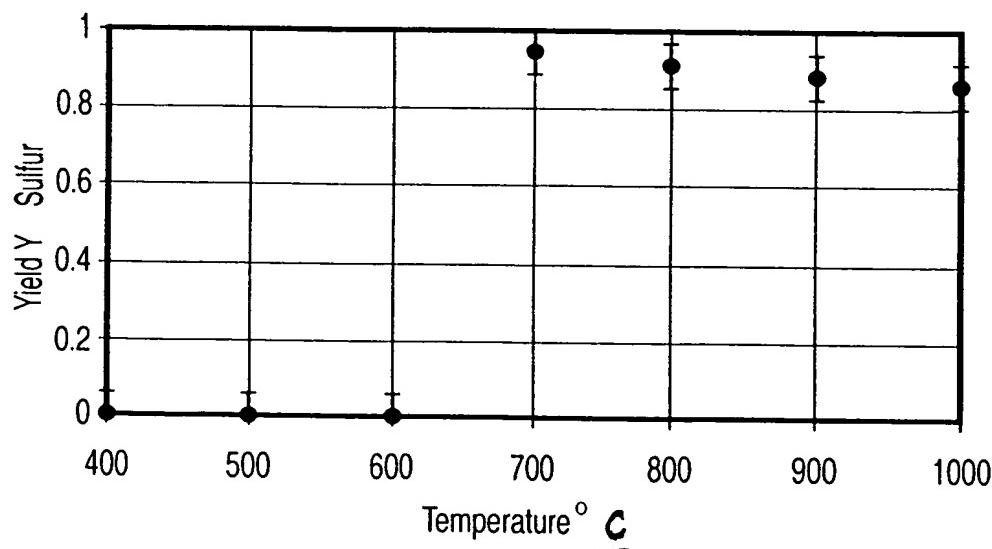


Figure 7

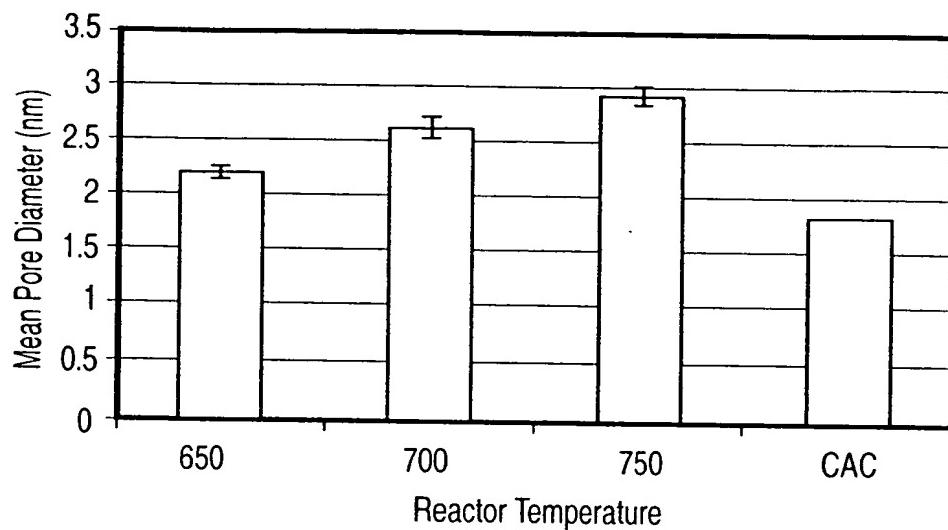


Figure 8

